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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/709,444	05/06/2004	Chien-Jung Sun	NTCP0025USA	3443
27765	7590	08/02/2005	EXAMINER	
NORTH AMERICA INTERNATIONAL PATENT OFFICE (NAIPC)			DANG, TRUNG Q	
P.O. BOX 506			ART UNIT	
MERRIFIELD, VA 22116			PAPER NUMBER	
			2823	

DATE MAILED: 08/02/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	Application No. 10/709,444	Applicant(s) SUN ET AL. <span style="float: right;">(PM)</span>	
	Examiner Trung Dang	Art Unit 2823	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 11 July 2005.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-7 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-7 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
     Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
     Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)             | 4) <input type="checkbox"/> Interview Summary (PTO-413)                     |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)    | Paper No(s)/Mail Date. _____  |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____   | 6) <input type="checkbox"/> Other: _____                                    |

### **DETAILED ACTION**

1. The indicated allowability of claims 7 and 8 is withdrawn in view of the newly discovered reference(s) to Akatsu et al. (US 2005/0026382) and Belyansky et al. (US 2005/0009267). Rejections based on the newly cited reference(s) follow.

#### ***Claim Rejections - 35 USC § 103***

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 1, 3-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Akatsu et al. as noted above in view of Schrems (US 6,580,110).

With reference to Figs. 6-10, Akatsu teaches a method for fabricating a bottle shaped deep trench comprising:

- a) providing a substrate having a pad layer 230 thereon;
- b) etching the pad layer and the substrate to form a deep trench, the deep trench having a sidewall and a bottom surface;
- c) performing an atomic layer deposition (ALD) process to form a nonmetal layer 660 on the pad layer and on an upper portion of the sidewall of the deep trench, the nonmetal layer formed on the sidewall of the deep trench directly contacting the upper portion of the sidewall of the deep trench (Fig. 7); and

d) performing a wet etching process by taking the nonmetal layer as a hard mask to remove a portion of the sidewall and the bottom surface of the deep trench not covered by the nonmetal layer so as to form a bottle-shaped deep trench.

Note that, since claim 1 does not exclude the trench deepening process of Fig. 6 that results in the deep trench of Fig. 7 in which the nonmetal layer 660 is formed on the pad layer and on an upper portion of the sidewall of the deep trench by performing an ALD process, steps a) to c) reads on the corresponding steps of claim 1. See para. [0047] for the claimed limitation regarding nitride layer 660 is formed by ALD and is directly contacting with the upper portion of the sidewall of the deep trench.

Akatsu differs from the claims in not disclosing the wet etching process of step d) is an isotropic etching as recited in the claim.

Schrems teaches a process in which a bottle-shape trench is formed by isotropic wet etch a lower portion of a deep trench using  $\text{NH}_4\text{OH}$  (col. 11, lines 10-13, lines 32-34; col. 12, lines 42-47).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Akatsu's process by performing the wet etching of step d) using the  $\text{NH}_4\text{OH}$  isotropic wet etch as suggested by Schrems because applying a knowledge generally available to one of ordinary skill in the art such as employing an old technique to make the same would have been obvious since it is well settle that the

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rationale to modify or combine the prior art does not have to be expressly stated in the prior art but may be reasoned from common knowledge in the art. In re Fine, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988); In re Jones, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992); In re Nilssen, 851 F.2d 1401, 1403, 7 USPQ2d 1500, 1502 (Fed. Cir. 1988).

For claim 3, it is noted that the ALD process is a process which inherently comprises a plurality of ALD processes. That is, an ALD film having a desired thickness is formed by a plurality of cycles, wherein each cycle deposits a monolayer or atomic layer and the cycle is repeated several times until a desired thickness is obtained (reference to Lee et al. (US 6,468,924 of record) is cited herein merely for the purpose of showing this fact, but not used in the rejection).

For claim 7, see Fig. 10 in the primary reference for the removal of nitride layer 660 after forming the bottle-shaped deep trench.

4. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Akatsu et al. taken with Schrems as applied to claims 1, 3-7 above, and further in view of Lee et al. (US 6,468,924 of record).

The combination of Akatsu and Schrems teaches the method as described above. The combined process differs from the claim in not disclosing that the ALD process is performed in a low-pressure chemical deposition (LPCVD) chamber.

Lee teaches an ALD method for depositing a nitride film, wherein the ALD process is performed in a LPCVD chamber (col. 4, lines 41-67).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the combined process of Akatsu and Schrems by performing the ALD process in a LPCVD chamber because such would produce high quality nitride film having good step coverage as suggested by Lee (col. 5, lines 26-39).

5. Claims 1, 3-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Belyansky et al (US 2005/0009267) in view of Schrems cited above.

With reference to Figs. 1-4 and 6A, Belyansky teaches a method for fabricating a bottle shaped deep trench comprising:

- a) providing a substrate having a pad layer 20/30 thereon;
- b) etching the pad layer and the substrate to form a deep trench, the deep trench having a sidewall and a bottom surface (Fig.1);
- c) performing an atomic layer deposition (ALD) process to form a nonmetal layer 120 on the pad layer and on an upper portion of the sidewall of the deep trench, the nonmetal layer formed on the sidewall of the deep trench directly contacting the upper portion of the sidewall of the deep trench (Fig. 2 and para. [0038]);
- d) performing a etching process by taking the nonmetal layer 120 as a hard mask to remove a portion of the sidewall and the bottom surface of the deep

trench not covered by the nonmetal layer so as to form a bottle-shaped deep trench (Fig. 4).

Belyansky differs from the claims in not disclosing the etching process of step d) to form bottle-shaped deep trench is an isotropic etching as recited in the claim.

Schrems teaches a process in which a bottle-shape trench is formed by isotropic wet etch a lower portion of a deep trench using  $\text{NH}_4\text{OH}$  (col. 11, lines 10-13, lines 32-34; col. 12, lines 42-47).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Belyansky's process by performing the etching process of step d) using the  $\text{NH}_4\text{OH}$  isotropic wet etch as suggested by Schrems because applying a knowledge generally available to one of ordinary skill in the art such as employing an old technique to make the same would have been obvious since it is well settled that the rationale to modify or combine the prior art does not have to be expressly stated in the prior art but may be reasoned from common knowledge in the art. In re Fine, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988); In re Jones, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992); In re Nilssen, 851 F.2d 1401, 1403, 7 USPQ2d 1500, 1502 (Fed. Cir. 1988).

For claim 3, it is noted that the ALD process is a process which inherently comprises a plurality of ALD processes. That is, an ALD film having a desired thickness is formed by a plurality of cycles, wherein each cycle deposits a monolayer or atomic layer and the cycle is repeated several times until a desired thickness is obtained

(reference to Lee et al. (US 6,468,924 of record) is cited herein merely for the purpose of showing this fact, but not used in the rejection).

For claim 4, see paras. [0017], [0043] for the disclosure of the nonmetal layer 120 is an ALD nitride layer or an ALD oxide layer.

For claim 7, since the claim does not limit to a complete removal of the nonmetal layer, the partial removal of ALD spacer layer 120 depicted in Fig. 6A reads on the claimed limitation.

6. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Belyansky et al. taken with Schrems as applied to claims 1, 3-7 above, and further in view of Lee et al. (US 6,468,924 of record).

The combination of Belyansky and Schrems teaches the method as described above. The combined process differs from the claim in not disclosing that the ALD process is performed in a low-pressure chemical deposition (LPCVD) chamber.

Lee teaches an ALD method for depositing a nitride or oxide film, wherein the ALD process is performed in a LPCVD chamber (col. 4, lines 41-67).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the combined process of Belyansky and Schrems by performing the ALD process in a LPCVD chamber because such would produce a high quality film having good step coverage as suggested by Lee (col. 5, lines 26-39).



***Conclusion***

7. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Trung Dang whose telephone number is 571-272-1857. The examiner can normally be reached on Mon-Friday 9:30am-6:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith can be reached on 571-272-1907. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Trung Dang  
Primary Examiner  
Art Unit 2823

7/27/05

A handwritten signature in black ink, appearing to read 'Trung Dang', with a long horizontal flourish extending to the right.